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more abundantly in the upper parts of the trees, and are the cause of increased sap concentration. Any agreement between observed increments of osmotic pressure and theoretical values calculated from the increased hydrostatic head and resistance to be overcome in the tracheae by virtue of higher position is regarded as a coincidence, and not as a proof of adjustment on the part of the cells to the back pull of increased head and resistance.—CHARLES A. SHULL.

Antagonism.—Antagonism between iron and manganese in their effects on the growth of two varieties of wheat has been investigated by TOTTINGHAM and BECK.[14] Manganous chloride in water cultures even in low concentrations reduces root growth, but when ferric chloride is added in about equimolecular (0.00001M) concentration the deleterious effects of the manganous salt are overcome. The two varieties of wheat used did not give exactly the same results, and it is believed that effects will depend on variety to a certain extent. Thus the amount of reserve iron in the seed would influence the response of the plant to variations in supply of salts of these two metals. In very dilute solutions the manganous chloride seemed to have stronger effects than ferric chloride on the color and growth, while in higher concentrations (0.001M) the iron salt had more effect than the manganese. Although the concentrations used approach that of these salts in the soil solution, no conclusions as to antagonism in soil cultures can be drawn because of the great variety of other salts and conditions which might modify the result.

SKINNER[15] has studied the effects of manganese sulphate and some other inorganic substances in overcoming the unfavorable action of vanillin and salicylic aldehyde on plants grown in culture solutions of varying composition. He finds that vanillin reduces the growth of cow peas, but the presence of nitrate reduces the unfavorable action, and may even entirely overcome the reduction of growth caused by vanillin. The harmful effects of salicylic aldehyde in 5 and 10 ppm. concentrations on wheat seedlings were entirely overcome by manganese sulphate in 10 ppm. concentration; and the harmfulness of vanillin was also partially overcome by manganese sulphate. He explains the action of nitrate and manganese on the ground that they favor root oxidation, whereby the harmful organic compounds are oxidized and are not permitted to influence growth unfavorably.—CHARLES A. SHULL.

The embryo sac of Aster and Solidago.—These much investigated embryo sacs have been studied again, this time by PALM,[16] a pupil of ROSENBERG.

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[14] TOTTINGHAM, W. E., and BECK, A. J., Antagonism between manganese and iron in the growth of wheat. Plant World **19**:359–370. 1916.

[15] SKINNER, J. J., The effect of vanillin and salicylic aldehyde in culture solution and the action of chemicals in altering their influence. Plant World **19**:371–378. 1916.

[16] PALM, BJ., Zur Embryologie der Gattungen *Aster* und *Solidago*. Acta Horti Bergiani **5**:1–18. *figs. 27*. 1914.

Aster novae-angliae and *Solidago serotina* were the principle species under examination. Several figures show that a tetrad of four megaspores is formed, as would have been expected. In regard to later stages, PALM disagrees with the results of the reviewer[17] and the subsequent study of Miss OPPERMAN,[18] for he claims that the extensive development in the antipodal region is due to the growth of the lower megaspores of the tetrad. His series is far from complete, however, and his figures, interpreted in this way, do not show any antipodal cells. While my own series, published more than 20 years ago, was incomplete, and Miss OPPERMAN's lacked stages in the early development, I see no reason why either of us should change our view that the chalazal development results from the enlargement of one or more of the antipodal cells. To prove his claim, PALM should present figures of the 8-nucleate stage of the sac, followed by a close series showing the disappearance of the antipodal cells or nuclei. Since such figures are lacking, we prefer to interpret the enlarged cells in the chalazal region as antipodals and not as persistent megaspores.—CHARLES J. CHAMBERLAIN.

The vegetation of Connecticut.—Continuing the studies previously noted,[19] NICHOLS[20] in a fourth paper has considered the vegetation of the swamps and bogs of Connecticut. The latter presents the more interesting group of plant associations, conspicuous among which is the bog forest of *Picea mariana* and *P. rubra*, occasionally supplemented by *Pyrus americana*, constituting a remarkable aggregation of northern trees. These trees, together with shrubs and herbs of northern affinities, lead the author to a consideration of the much discussed question of the origin of bog vegetation, resulting in the opinion that the vegetation is that of a relic swamp type, representing the vestigial remnants of a more northern type of flora which dominated the region within a geological time decidedly more recent than the Pleistocene.

In a similar connection it is interesting to note that in the fifth paper attention is directed to the fact that the rock ravine is second only to the bog for its display of northern species. This paper gives a careful survey of the plant communities associated with stream erosion and deposition. None of the associations are of striking interest, but it serves to round out a comprehensive study of the vegetation of the state.—GEO. D. FULLER.

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[17] CHAMBERLAIN, C. J., The embryo sac of *Aster novae-angliae*. BOT. GAZ. **20**: 205–212. *pls. 15, 16.* 1895.

[18] OPPERMAN, MARIE, A contribution to the life history of *Aster*. BOT. GAZ. **37**:353–362. *pls. 14, 15.* 1914.

[19] BOT. GAZ. **59**:159–160. 1915.

[20] NICHOLS, G. E., The vegetation of Connecticut. IV. Plant societies of the lowlands. V. Plant societies along rivers and streams. Bull. Torr. Bot. Club **42**:169–217. *figs. 15.* 1915; **43**:235–264. *figs. 11.* 1916.